

they too have intelligence, and that they exhibit at times a very respectable amount of common sense. The stories about them are strictly true, and from their very nature strictly new. But the volume tells also of many a two-footed friend, and the last few chapters almost exclusively treat of the fishes of the coast. There is much in this portion of the volume of interest to the scientific worker; there is much in every part of it to make it of value to those who care to learn something of the habits of Tasmanian beasts, birds, and fishes. One feature of the volume must be specially noticed—the eight coloured drawings, excellently chromolithographed from the water-colour drawings of the author. From a personal knowledge of the splendid colouring often present in freshly-caught tropical fishes, these plates are, we should say, by no means too brilliant. Four are devoted to some of the strange, wondrously-coloured fishes, and four to flowers, fruits, and insects.

This volume would be an excellent and not over-expensive Christmas present, which may lie on any table however select, and be read by any person however critical.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Mr. Spencer and Prof. Tait

PROF. TAIT's explanation itself shows that the word commonly applied to products of imagination, was applicable to his statements; for the only justification he assigns is that he "assumed," that is to say, imagined, that his substitution of "definition" for "formula" must have been the ground of offence. How inadequate a plea this is, will be seen on re-reading the questions I put, which were these:—

"He [Prof. Tait] says that because he has used the word 'definition' instead of 'formula,' he has incurred my 'sore displeasure and grave censure.' In what place have I expressed or implied displeasure or censure in relation to this substitution of terms? Alleging that I have an obvious motive for calling it a 'formula,' he says I am 'indignant at its being called a definition.' I wish to see the words in which I have expressed my indignation; and shall be glad if Prof. Tait will quote them. He says:—'It seems I should have called him the discoverer of the formula!' instead of 'the inventor of the definition.' Will he oblige me by pointing out where I have used either the one phrase or the other?"

Every reader would infer that, for these specific statements made by Prof. Tait, there are specific foundations, which could be named when asked for. He does not name them, for the sufficient reason that they do not exist. Unable, as he says, to see in the passages I quoted from him, anything else to call for "censure" (a strange inability!), he "of course" assumed that this change of terms was the ground of censure. And the assumption thus made, is the only warrant he assigns for these positive assertions.

This is not all, however. Prof. Tait says:—"I could not have ventured to suppose that Mr. Spencer 'did not even know that he was in the habit of saying formula rather than definition.' This naive confession cannot but be correct." Of Prof. Tait's motive for putting this statement of mine in italics and calling it naive, the reader may judge for himself. How entirely correct it is, and how well Prof. Tait might have "ventured to suppose" it, will quickly appear. For there is proof that I am not in the habit of always saying formula rather than definition; and Prof. Tait had the proof before him. In the note on page 565 of the Appendix forming the pamphlet in question—a page which Prof. Tait must have read, since it concerns Mr. Kirkman and himself—I have used the word "definition." So that not only had Prof. Tait no evidence on which to base his distinct statements,

but there was under his eyes positive evidence which negated them.

Very possibly it will be said that the question about my uses of these words is a trivial one. But this is not the question. The question is whether it is allowable to make an opponent look absurd by ascribing to him, in a quite positive way, things which he has neither said nor implied; and that, too, when he has implied the contrary. HERBERT SPENCER

Criterion of Reality

WILL you kindly allow a learner to ask for the criterion according to which Kinetic Energy and Work are real things, while Momentum and Force are unreal? Prof. Tait says $\frac{1}{2}mv^2$ and wh express real things, but mv and wt unrealities (NATURE, vol. xxiii. p. 82).

If wt be "as unreal as is the product of a quart into an acre," how is it that wh is real? The illustration of quart and acre is as applicable or inapplicable to the one as to the other. In both cases we take the product of two numbers, not two concrete magnitudes, which of course it would be absurd to speak of multiplying together. In one case the product is the number of units of Momentum, in the other case it is the number of units of Kinetic Energy. If it be said that a thing is real if its quantity cannot be altered, and *vice versa*, why is mv^2 said to be real, and mv unreal? They vanish together. When Prof. Tait asserts "there is no such thing as Force," "it is merely a convenient expression for a certain rate" (NATURE, vol. xiv. p. 459), he seems, if I may venture to say so, to confound the measure of Force with Force itself, and to lay himself open to Mr. Spencer's comment that "a relation changes the state of a body." Certainly mv is not a thing, but neither is mv^2 a thing: yet the latter is the measure of something which Prof. Tait asserts to be "as real as matter itself": why is not that of which the former is the measure equally real? E. G. Bardsea

[What Prof. Tait asserts may be correct or not, but it is self-consistent. He asserts in his lecture on "Force" (NATURE, vol. xiv. p. 462) that matter and energy must be looked on as real things, because we cannot change the amount of either. Such expressions as $\frac{1}{2}mv^2$, and wh , are to be considered as wholes, not as products of two or more factors. This separation into factors (where one is mv , or w , for instance) he asserts to be a relic of the old erroneous belief in the trustworthiness of the impressions made on the "muscular" sense.—Ed.]

Landslips

IN NATURE, vol. xxii. p. 560, I pointed out that landslips often occurred in the Salt Districts. I did not then expect that I should so soon be able to refer again to the subject; but on December 6, at an early hour in the morning, one of the largest subsidences and landslips ever known in Cheshire occurred. I pointed out that whenever fresh water reaches the rock salt it dissolves it. In certain districts in the immediate neighbourhood of Northwich the ground is completely honeycombed with rock-salt mines that had been worked out and abandoned. Into many of these fresh water had penetrated, and had become by solution strong brine. This brine has of late been extensively pumped up, and many of these extensive cavities had become nearly empty. The thin crust of rock salt forming the roof of these old mines had become gradually thinner, owing to its solution by water, and on Monday morning the roof of one pit gave way, and let the superincumbent earth down into the mine, rifling and opening the ground to the surface. The surface rift passed across the bed of a large brook, and the water of the brook ran through the crevice into the mines below. In a short time the water made a more extensive cavity, and as the brook was cut in two about 200 yards above its entrance into a large lake that was drained by the Weaver River, the water in the lower portion of the brook and of the lake, as well as of the Weaver, commenced to return and run down the enlarged cavity. For four or five hours this return stream increased in velocity, pouring down the crater-like hole. Notwithstanding the water of the brook and the return water, as well as a large body of water from another small lake entering this cavity, the water standing in the funnel-shaped hole gradually lowered. The velocity of both portions of the brook increased, and such was the force of the water that the bottom of the brook for 100 yards was scooped out from 2 feet in depth to 10 feet, and the banks were washed away,

making the brook from 30 to 40 feet wide instead of 20 as at first.

The quantity of water thus rushing down for twelve hours from the commencement would be fully 600,000 tons. The water in one direction over a surface of 160 acres was lowered one foot in the space of three hours. Shortly after this water commenced to rush below it made its way through a weak portion of a barrier wall into a rock salt mine that was being worked. This mine, extending over fifteen acres, and having a worked-out depth of eighteen feet, was completely filled and all the tools, materials, waggons, tramways, &c., entirely lost. It will be quite impossible ever to pump out the water. Besides this mine, all the old abandoned mines were filled, and the brine, which stood at 100 yards from the surface on the Sunday, stood at 24 yards on Monday night. The water being fresh, great damage was expected by the solution of the salt. This soon occurred, for an old mine that fell in forty-two years ago, and the cavity of which had been filled with water, gave way, and suddenly the whole land over a circle of about 500 feet in diameter sank, and a large portion of water escaped into neighbouring pits. The ground cracked and rifted and subsided, and a length of road of 160 yards was destroyed, as also pipes conveying brine to the salt works. A large reservoir holding brine was split across and all the brine let out; the rending of the earth passed through two kilns of bricks, dropping one-half of the kilns at least 2 feet. On the Monday afternoon a tall chimney 90 feet in height became affected, and in a few hours fell with a great crash. The air that had filled the cavities below was forced out by the inrush of water, and caused all the pits and brooks near to bubble and boil violently, whilst in some of the rifts where water occurred miniature mud geysirs were formed, throwing up mud 10 or 12 feet high. These appearances extended over a district between two brooks for the space of 2000 feet. On Wednesday night a large hole 30 yards in diameter and 30 yards deep fell in, and more subsidences are daily expected, as the fresh water will eat away the pillars supporting the roofs of the abandoned mines.

The cavity formed on Monday is full of water, and the brook now runs through it. Some idea may be formed of it when I mention that it is crater-like, and of about 200 feet in diameter. On sounding it on Wednesday I found a depth of 78 feet of water in the centre, and various depths from 70 to 60, 50, and so on to about 12 feet at the margin. On Sunday, on the spot which is now 78 feet, there was a sandbank with its surface above the water.

Serious injury has been done to one set of salt works, and five sets are stopped for want of brine, the pipes being broken and the road destroyed.

As the salt trade increases these enormous sinkings keep increasing, and become more alarming in their character.

Brookfield House, Northwich

THOS. WARD

The Geology of East-Central Africa and the Subterranean Forest in Bombay

IN Mr. J. Thomson's very interesting "Notes on the Geology of East-Central Africa" (*NATURE*, vol. xxiii. p. 104) he remarks that doubtless the immense development of volcanic rocks described by myself (and I may add by several previous explorers) in Abyssinia is of the same age as the volcanic rocks at the Cape of Good Hope, assigned to the Trias.

Mr. Thomson has, I think, overlooked the circumstance that whatever may be the age of the Cape volcanic rocks, the teaks of Abyssinia cannot be older than Jurassic. As I have shown (*Quart. Jour. Geol. Soc.*, 1869, pp. 403, &c.), and "Geology and Zoology of Abyssinia," pp. 184, &c.), there are in the Abyssinian highlands two groups of bedded dolerites and trachytes, the upper of which rests unconformably on the lower, while the latter overlies limestone with Jurassic (Middle Jurassic) fossils.

I trust that Mr. Thomson will pardon my suggesting the possibility of the Tanganyika sandstones being river valley deposits, like the Gondwana series of India, rather than lacustrine. I may be mistaken, but the description appears to me to indicate beds coarser than those usually deposited in an extensive lake basin.

In the same number of *NATURE*, p. 105, is a brief notice of a "Subterranean Forest in India." As I understand the account given, the forest should perhaps rather be termed submarine than subterranean. My object in calling attention to this notice however is to point out that a previous description of the same formation was published in the *Records of the Geological Survey*

of India for 1878, vol. xi. p. 302. This account is by Mr. G. E. Orniston, Resident Engineer, and agrees in all essential particulars with the note in *NATURE*. I appended a few remarks on the geological bearing of the discovery. The "forest" has clearly been depressed, whilst neighbouring tracts in Bombay island appear to have been elevated in comparatively recent times.

W. T. BLANFORD

Dr. Siemens's Gas-Grate

HAVING endeavoured for some years past to heat my study by gas appliances, and having utterly failed in obtaining a comfortable temperature of 60°, as a last effort to accomplish my object I had fitted into an ordinary grate Dr. Siemens's arrangement of copper and iron, the construction of which was communicated to the public in the pages of *NATURE*, vol. xxiii. p. 25. Before giving the results of the trial of Dr. Siemens's gas-grate I may mention in what way my former gas-stoves failed. My first gas-fire consisted of gas and asbestos, but this gave out fumes which were quite intolerable; my second trial was with a gas-stove reflecting heat from a copper lining; this not only failed to warm the room, but was a cheerless and grim apology for a fire, and to obtain even a moderate degree of temperature a constant and expensive consumption of gas was necessary. With Dr. Siemens's gas-grate all that is required to produce a good cheerful fire radiating heat to all parts of the room, and maintaining a temperature from 60° to 62°, is to turn on the gas full for about twenty minutes, and as soon as the lower stratum of coke becomes incandescent, the gas may be quite turned off, the fuel, whether coke or anthracite, continuing to burn for five or six hours without any further expenditure of either gas or fuel.

If the fire is required for a longer time, or if at any time a more rapid combustion is wanted, it is only necessary to turn on the gas again for a few minutes and add more fuel. This is my experience of Dr. Siemens's gas-grate, and I consider it a great boon to householders who desire well-warmed rooms combined with economy. After the lucid description of the gas-grate given by Dr. Siemens in *NATURE*, it would be presumption in me to discuss the scientific explanation of its action; I shall only, in conclusion, venture to claim for it the following advantages which I believe it to possess over every other kind of gas-stove yet invented:—

1. It gives a clear, smokeless, cheerful fire.
2. It is most economical, and very soon pays the cost of the construction.
3. Being absolutely smokeless, contributes nothing to that constituent of our London fogs which renders them injurious in so many ways.

This last advantage, if multiplied by every householder at an outlay of 25s., adopting a cheaper modification than the copper and iron gas-grate, we should before very long observe a marked change for the better in our London atmosphere; and the darkness, dirt, and destruction of property with which we Londoners are annually afflicted, would be things of the past.

December 13

R. DOUGLAS HALE

Geological Climates

I HAVE just read Mr. A. R. Wallace's letter in *NATURE*, vol. xxiii. p. 124, but as I have not yet seen his book, "Island Life, although my bookseller had promised it, I shall defer my reply in *NATURE* until I shall have made myself master of his ideas.

For the present I shall only say:—1. That Mr. Wallace's proposal would benefit the Polar regions but not Bournemouth. 2. Mr. Wallace omits all mention of the *return cold currents* which the admission of two new Gulf Streams into the Arctic regions would produce. These currents would seriously lower the temperature of China and Japan; and also of the Ural Mountains and east of Europe.

SAMUEL HAUGHTON

Trinity College, Dublin, December 10

SOME weeks since the Rev. Prof. Haughton took exception to a brief letter of mine, in which I suggested that as a bamboo flourishes in Cooper's Hill College garden, in a northern aspect winter after winter, it could be used effectually in an argument relating to geological climates. The bamboo being found in torrid India now, that at Cooper's Hill, if found in a future period, would, according to some geologists, indicate that the valley of the Thames was tropical formerly. My letter was